Ramie Fiber as a Novel Green Electric Double Layer Capacitor Materials

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A novel green electric double-layer capacitor (EDLC) have been succesfully made from carbonized ramie fiber using a single step method with ammonia gas (NH3). Ramie (Boehmerianivea L.) is fiber crops that abundantly planted in the world including Indonesia, China, India, Japan, South America. Due to an excellent fiber characteristics and a high cellulose content, ramie fiber has a high potential as green EDLC materials. At present EDLC materials are mainly made from nonrenewable resources such as polyacrylonitrile, or pitch which came form petroleum or coal. In this research, first ramie fiber was degummed to obtain pure cellulose. The cellulose was pyrolyzed at temperature of 800 oC for 2 hours under the nitrogen or nitrogen followed by ammonia gases. The surface area was determined using the Brunauer Emmertt Teller (BET), and the functional groups was analyzed using Fourier transform infrared spectra (FTIR). The two carbon samples were processed into electrodes with Polyvinylidene Fluoride and N,N-Dimethylacetamide.The electrodes were characterized using X-ray diffraction (XRD) and scanning electron microscopy (SEM). The electrodes were arranged into EDLC sheets with addition of Na2SO4. The electrochemical properties were determined with cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The results shown that the surface area of carbon pyrolyzed using N2 is 119 m2/g, while that of NH3 is 144 m2/g. The SEM analysis showed that the size of carbon pyrolized using NH3 are smaller and more homogenous leads to more optimal echant effect. The obtained capacitance of the material is 0.27 mF/g and exhibited a high stability in cyclic test (charge-discharge). Keywords: ramie fiber, activated carbon, ammonia gas, electric double-layer capacitor